PATENT ABSTRACTS OF JAPAN

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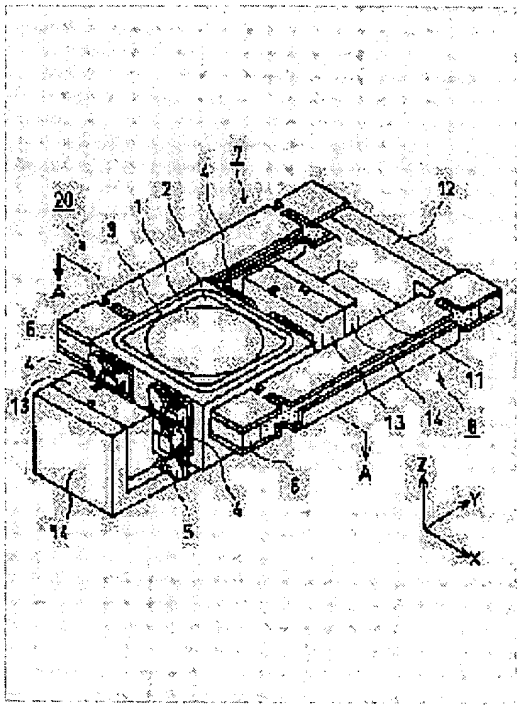
(54) OBJECTIVE LENS DRIVING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an object lens driving device in which a light spot of an objective lens is not largely displaced even if tilt of an object lens is corrected.

SOLUTION: This device has an objective lens 1, an objective lens sustaining member 2, supporting members 7, 8 supporting the sustaining member in a displaceable state, a tilt coil 5 which is fixed to the sustaining member and rotates the sustaining member around a shaft almost intersecting at right angle to the direction of an optical axis of an objective lens, and magnetic field applying means 13, 14 applying magnetic fluxes to the tilt coil. In this case, this device is constituted so that the center of rotation of the objective lens by the tilt coil and the magnetic field applying means almost coincides with a nodal point of the object lens.



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CLAIMS

[Claim(s)]
[Claim 1] An objective lens, the attachment component holding said objective lens, and the supporter material supported possible [displacement of said attachment component], In the objective lens driving gear which has the tilt coil which fixes to said attachment component and is made to rotate said attachment component to the circumference of the shaft which intersects perpendicularly with the direction of an optical axis of said objective lens mostly, and the field impression means to which magnetic flux is made to impress to said tilt coil The rotation core of said objective lens by in collaboration with said tilt coil and a field impression means is an objective lens driving gear characterized by constituting so that it may be mostly in agreement with the nodal point of said objective lens.
[Claim 2] It is the objective lens driving gear characterized by being in agreement with the center of gravity of the moving part which rotates the rotation core of said objective lens to the circumference of said shaft in an objective lens driving gear according to claim 1.
[Claim 3] It is the objective lens driving gear by which it is characterized [which is characterized by being in agreement focusing on the support the rotation core of said objective lens is supported by said whose supporter material in an objective lens driving gear according to claim 1].

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the objective lens driving gear in the information record regenerative apparatus which records or reproduces information optically to a record medium, for example, a Magnetic-Optical disk drive, a postscript mold disk drive, a phase change mold disk drive, a CD-ROM drive, a DVD drive, etc.
[0002]
[Description of the Prior Art] In the information record regenerative apparatus which reproduces information at least optically to a record medium, convergent radiotherapy of the light beam is carried out with an objective lens, a very small light spot is formed on a record medium, and the information signal is reproduced. However, if the optical axis of an objective lens does not make it irradiate by the proper angle of incidence to the information recording surface of a record medium, optical aberration will occur, a cross talk and a jitter will increase, and an information signal will deteriorate. Moreover, if the optical axis of an objective lens inclines in case information is recorded on an information recording surface, the information signal which should be recorded will deteriorate and the fault that a right pit mark is not formed will arise.
[0003] In order to solve such fault, the objective lens driving gear indicated by JP,7-65397,A (it is hereafter called the conventional example 1) is proposed. The objective lens driving gear indicated by this conventional example 1 is shown in drawing 11 . Hereafter, with reference to drawing 11 , the configuration of this objective lens driving gear is explained.
[0004] As shown in drawing 11 , Y and the direction of a path of an optical disk are set [the direction of an optical axis of an objective lens 51] to X for the hoop direction of Z and an optical disk. The objective lens 51 is held at the holder 52. the focal coil 53 winds around the side face of a holder 52 horizontally -- having -- moreover -- the side face of the hoop direction (the direction of Y) of a holder 52 -- the tracking coils 54a-54d (not shown [54d]) -- moreover, the tilt coils 55a-55d (not shown [55d]) are attached in the part located in each tracking coils [54a-54d] lower part.
[0005] The 1st and 2nd tilt coil 55a and 55b and the 3rd and 4th tilt coil 55c and 55d are arranged along the direction of a path of an optical disk so that it may become the X-axis and axial symmetry. In this case, the tilt coils 55a and 55c and the tilt coils 55b and 55d will be arranged along the hoop direction of an optical disk.
[0006] On both sides of the objective lens 51, the direction inclination detectors 61a and 61b of a path are attached in the top face of a holder 52 along the direction of X. Moreover, on both sides of the objective lens 51, the hoop direction inclination detectors 61c and 61d are attached along the direction of Y.
[0007] The end of four parallel supporting material 56a-56d fixes on the side face of this holder 52, and the other end fixes to the supporting-material fixed part 58 attached on the pedestal 57. A holder 52 supports supporting material 56a-56d possible [jogging and tilting in the four directions of the direction a of a focus (Z-axis), the direction b of tracking (X-axis), direction inclination of path c, and hoop

direction inclination d].
[0008] York 59a and 59b of the U character mold of a pair is attached in the direction of Y at the pedestal 57, and Magnets 60a and 60b have fixed in York 59a and 59b of the pair. York 59a and 59b constitutes the magnetic impression means with Magnets 60a and 60b.
[0009] Thus, actuation of the constituted objective lens driving gear is further explained also with reference to drawing 12 . The diffracted light which does not return to an objective lens 51 among the light which outgoing radiation was carried out from the objective lens 51, and condensed to optical disk D is received by the direction inclination detectors 61a and 61b of a path, and the hoop direction inclination detectors 61c and 61d. The optical axis of an objective lens 51 does not incline in the direction c of a path to optical disk D, but drawing 12 (a) shows the condition that the light income of the diffracted light received with the direction inclination detectors 61a and 61b of a path is equal. That is, an error signal does not arise in this condition. On the other hand, drawing 12 (b) shows the condition that the optical axis of an objective lens 51 leans in the direction c of a path to optical disk D, a difference arises in the light income of the direction inclination detectors 61a and 61b of a path, and an error signal arises.
[0010] That is, the inclination of the direction c of a path of an objective lens 51 can be amended by impressing a drive current to the tilt coils 55a-55d so that the error signal from the direction inclination detectors 61a and 61b of a path may be set to 0.
[0011] The inclination of the hoop direction d of the optical axis of an objective lens 51 can be amended like the case of the direction c of a path also about a hoop direction d by impressing a drive current which amends the error signal from the hoop direction inclination detectors 61c and 61d to the tilt coils 55a-55d.
[0012]
[Problem(s) to be Solved by the Invention] However, in the objective lens driving gear shown in drawing 11 , since the objective lens 51 is attached above the holder 52, when the objective lens 51 and the center of gravity of moving part (it consists of an objective lens 51, a holder 52, and each drive coil) have shifted in a Z direction and an objective lens 51 is leaned by 55d from tilt coil 55a, the fault which displaces in the direction which the objective lens leaned and also displaces an optical spot in connection with it will arise.
[0013] For example, if the drive current of the predetermined sense is impressed to 55d from tilt coil 55a so that the optical axis of an objective lens 51 may be leaned to the circumference of a Y-axis, an objective lens 51 will move in the direction of X while inclining to the circumference of a Y-axis, and an optical spot will move it in the direction of X. Migration of this optical spot needs to serve as disturbance of the direction of X, and needs to amend by impressing a drive current to the tracking coils 54a-54d. Therefore, the load of the servo of the direction of tracking becomes large, and the fault which the consumed electric current increases is caused.
[0014] Moreover, like the case of the circumference of the X-axis, when the optical axis of an objective lens is leaned to the circumference of the X-axis, an objective lens will move in the direction of Y while inclining to the circumference of the X-axis, and an optical spot will move it in the direction of Y. Since it does not have a drive for making an objective lens drive in the direction of Y in the common objective lens driving gear in an information record regenerative apparatus, migration of an optical spot in this direction of Y cannot be amended. Therefore, a jitter occurs, the reflected light from a record medium, incidence will be carried out, offset will arise in a tracking error and a focusing error signal, and an exact servo will become impossible. [to the object for tracking, and the photodetector for focusing]
[0015] Even if this invention was made paying attention to such fault and performs inclination amendment of an objective lens, it aims to let the optical spot of an objective lens offer the objective lens driving gear which is not displaced greatly.
[0016]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the objective lens driving gear of this invention An objective lens, the attachment component holding said objective lens, and the supporter material supported possible [displacement of said attachment component], In the

objective lens driving gear which has the tilt coil which fixes to said attachment component and is made to rotate said attachment component to the circumference of the shaft which intersects perpendicularly with the direction of an optical axis of said objective lens mostly, and the field impression means to which magnetic flux is made to impress to said tilt coil The rotation core of said objective lens by in collaboration with said tilt coil and a field impression means was constituted so that it might be mostly in agreement with the nodal point of said objective lens.

[0017] For this reason, even if it rotates an attachment component by in collaboration with a tilt coil and a field impression means, it will rotate focusing on the nodal point of an objective lens mostly, the nodal point of an objective lens does not shift greatly, and an attachment component becomes very small [the amount of displacement of an optical spot].

[0018] It is more specifically making in agreement the rotation core of said objective lens, and the center of gravity of the moving part which rotates to the circumference of said shaft, and constituting an objective lens driving gear, and even if it rotates moving part on a low frequency, the amount of displacement of an optical spot becomes very small.

[0019] Moreover, with making it in agreement focusing on the support supported by the rotation core and said supporter material of said objective lens, and constituting an objective lens driving gear, even if it rotates moving part on a high frequency, the amount of displacement of an optical spot becomes very small.

[0020]

[Embodiment of the Invention] Hereafter, the objective lens driving gear concerning the 1st operation gestalt of this invention is explained with reference to drawing 1 thru/or drawing 6 .

[0021] This objective lens driving gear is an objective lens driving gear in the Magnetic-Optical disk drive which uses a magneto-optic disk as a record medium, and performs record and playback to a magneto-optic-recording medium. Among the axes of coordinates in drawing, as for the direction of X, the direction of tracking (the direction of a normal of a code track) and the direction of Y show the tangential direction (tangential direction of a code track), and the Z direction shows the direction of focusing (they are a perpendicular direction and the direction of an objective lens optical axis to a magneto-optic-disk side).

[0022] As shown in drawing 1 , the objective lens 1 has fixed to the through hole formed in the center of a holder (attachment component) 2. A slot is formed in the top face of a holder 2 so that an objective lens 1 may be surrounded, and the focusing coil 3 wound around the slot is inserted, and fixes. Moreover, also in the direction of Y of a holder 2, two wound tracking coils 4 fix in a side face, and two wound tracking 4 fixes also like the side face of another side. In each outside of this tracking coil 4, a total of four tilt coils 5 fixes.

[0023] Moving part 20 consists of edges 9c and 10c by the side of an objective lens 1, a holder 2, the focusing coil 3, the tracking coil 4, the tilt coil 5, and the holder 2 of flat spring 9 and 10.

[0024] The fixing sections 6 and 6 are formed in the both sides of the direction of X of a holder 2, and the end of retaining springs 7 and 8 fixes in these fixing sections 6 and 6, respectively. A retaining spring 7 consists of flat spring (supporter material) 9 and 10 which has 0.5 thru/or an about 1.5mm gap, and is arranged up and down, and damping materials, such as silicon gel poured into the gap, as shown in drawing 2 . As for flat spring 9 and 10, the bending sections 9a and 10a of a narrow width are formed near the edges 9c and 10c of the direction both ends of Y, respectively. These bending sections 9a and 10a are formed so that it may shift in the direction of X slightly, as shown in drawing 3 (a). The bending sections 9b and 10b which bent crosswise (the direction of X) flank one side at the right angle are formed in the pars intermedia between [of two places] bending section 9a and 10a. And the bending sections 9b and 10b are attached so that it may counter mutually, and the cross section in the Z-X flat surface is constituted so that an oblong rectangle may be presented, as shown in drawing 2 . In addition, since a retaining spring 8 is constituted like a retaining spring 7, it omits the explanation.

[0025] The other end of retaining springs 7 and 8 fixes to the fixed part 12 which starts from the base 11 and is formed. Two magnets 13 (field impression means) fix in the two York sections 14 which started from the base 11, respectively so that it may counter with the tracking coil 4 and the tilt coil 5. In

addition, a magnet 13 fixes in the York section 14 so that the magnetic pole of the tracking coil 4 and the tilt coil 5, and two magnets 13 that counter may turn into N pole, respectively.
[0026] A magnetic-flux generating means consists of a magnet 13 and the York section 14. Here, the mutual physical relationship of the focusing coil 3, the tracking coil 4, and the tilt coil 5 and physical relationship with a magnet 13 are further explained to a detail with reference to drawing 1 and drawing 4 .
[0027] The center position in the Z direction fixes the focusing coil 3 to a holder 2 so that it may be in agreement with the center position in the Z direction of a magnet 13. The tracking coil 4 fixes to a holder 2 so that the center position in the Z direction may be in agreement with the center position in the Z direction of a magnet 13, and so that the effective sides (side which adjoins mutually [the inside of a tracking coil]) 41a, 42a, 43a, and 44a of the tracking coil 4 may be located in the effective field of a magnet 13. The center position in the Z direction of each effective side 51a, 52a, 53a, and 54a by the side of Z (+) fixes the tilt coil 5 to a holder 2 so that it may be in agreement with the center position in the Z direction of a magnet 13.
[0028] Next, the nodal point (hereafter referred to as N.P) of an objective lens, the center of gravity of moving part 20, and the relation based on [S] support are explained with reference to drawing 5 . Drawing 5 is the outline sectional view in which having cut the core of the objective lens 1 in drawing 1 into in respect of A-A parallel to a X-Z flat surface, and having shown it from the Y (-) side. Since the objective lens 1 of this operation gestalt is infinity optical system which is made to carry out incidence of the parallel light, and is made to condense on Disk D, in accordance with backside principal point Ho', backside principal point Ho' of N.P of an objective lens 1 of this objective lens 1 corresponds with the center of gravity G of moving part 20. Moreover, also in a flat surface parallel to a Y-Z flat surface, N.P of an objective lens 1 and the center of gravity G of moving part 20 are in agreement. And N.P of an objective lens 1 is in agreement further focusing on [S] support of rotation of the circumference of the middle point of the four bending sections 9a and 10a by the side of the holder 2 of the retaining springs 7 and 8 which support moving part 20, i.e., a Y-axis. Occasionally a support core has the case the rigidity of the four bending sections 9a and 10a and whose location are ununiformities where it separates from the middle point of this bending section. It is based on rotation of the moving part 20 at the time of giving static torque in the extension direction (the direction of Y) of retaining springs 7 and 8 in moving part 20 at the circumference of the shaft supposing an parallel shaft with the support core S.
[0029] The resonance frequency fr of the resonance mode which moving part 20 rotates to the circumference of a Y-axis with the torsion spring constant of the circumference of the Y-axis of the retaining springs 7 and 8 which are the moment of inertia and its supporter material of the circumference of the Y-axis of moving part 20 is determined. When the torque of the circumference of a frequency lower than fr or a static Y-axis is given to moving part 20, moving part 20 rotates centering on the support core S mostly. Moreover, when the torque of a frequency higher than fr is given to moving part 20, moving part 20 rotates centering on the center of gravity of moving part 20 mostly.
[0030] Next, an operation of this operation gestalt is explained with reference to drawing 4 and drawing 6 . Drawing 4 shows the focusing coil 3, the tracking coil 4, and the tilt coil 5 in diagram, and shows the condition of making it rotating to the circumference of a Y-axis by impressing a predetermined drive current to the tilt coil 5.
[0031] The drive current of the same direction is impressed and the driving force of Z (-) sense generates the tilt coils 51 and 53 prepared in the X (+) side among four tilt coils 5 (51, 52, 53, 54) the effective sides 51a and 53a. Moreover, in the tilt coils 51 and 53, the drive current of the opposite sense is impressed and the driving force of Z (+) sense generates the tilt coils 52 and 54 prepared in the X (-) side the effective sides 52a and 54a. For this reason, moving part 20 will rotate to the circumference of a Y-axis (seeing from Y (-) clockwise rotation). By naturally making reverse the sense of the drive current impressed to a tilt coil 5, it will see from Y (-) and will rotate counterclockwise.
[0032] With this operation gestalt, since it is made in agreement with N.P of an objective lens 1, the center of gravity G of moving part 20, and the support core S, even if it rotates moving part 20 to the circumference of a Y-axis with the tilt coil 5, the optical spot of an objective lens 1 does not move like

before. This reason is further explained to a detail.
[0033] The condition that the center of gravity G of moving-part 20' and the support core S of drawing 6 (a) do not correspond with N.P of an objective lens 1 is shown. If it is made to rotate whenever [theta] to the circumference of a Y-axis with the tilt coil 5 which does not illustrate this moving-part 20', it will rotate centering on that center of gravity G and the support core S, and, as for moving-part 20', N.P of an objective lens 1 will move only m to the X (-) side. That is, if distance from the center of gravity G of moving-part 20' to N.P of an objective lens 1 is set to l, as the movement magnitude m of the optical spot O serves as m=l-theta and l becomes large, the movement magnitude m of the optical spot O will become larger.
[0034] On the other hand, since the center of gravity G of moving part 20 and the support core S, and N.P of an objective lens 1 are made in agreement as this operation gestalt shows to drawing 6 (b), when moving part 20 is rotated whenever [theta] to the circumference of a Y-axis with the tilt coil 5, moving part 20 will rotate focusing on N.P of an objective lens 1. That is, since the distance l from the center of gravity G of moving part 20 to N.P of an objective lens 1 is 0, the movement magnitude m of the optical spot O is set to m=l-theta =0. Therefore, even if the optical spot O leans an objective lens 1 to the circumference of a Y-axis with the tilt coil 5, it does not shift in the direction of X and does not become the disturbance of the direction of tracking.
[0035] Moreover, with this operation gestalt, even if it rotates moving part 20 not only to the circumference of a Y-axis but to the circumference of the X-axis, since N.P of the center of gravity G of moving part 20 and an objective lens 1 is in agreement, the optical spot O does not move.
[0036] Moreover, with this operation gestalt, since N.P of an objective lens 1 is made in agreement in addition to the center of gravity G of moving part 20 focusing on [S] support of the circumference of a Y-axis, even when a frequency lower than the resonance frequency of the circumference of a Y-axis occurs in moving part 20 and moving part 20 rotates centering on the support core S, it will rotate focusing on N.P of an objective lens 1, and the movement magnitude m of the optical spot O becomes very small.
[0037] As explained above, according to this operation gestalt, the center of gravity G of the moving part 20 which consists of an objective lens 1, a holder 2, and the focusing coil 3, the tracking coil 4 and the tilt coil 5, and the support core S Since N.P which is N.P of an objective lens 1 is made in agreement, the rotation core when rotating moving part 20 with the tilt coil 5 is set to N.P of an objective lens 1, and migration of the optical spot O by rotating moving part 20 with the tilt coil 5 is lost.

[0038] Moreover, with this operation gestalt, since the weight balancer for center-of-gravity justification of moving part 20 is not needed in order to make in agreement the center of gravity of moving part 20, and N.P of an objective lens 1, moving part 20 can be made into a small light weight.
[0039] Moreover, since spacing of the up-and-down flat spring 9 and 10 was narrowed, the spring constant when rotating moving part 20 to the circumference of the X-axis can become small, and moving part 20 can be rotated to the circumference of the X-axis with a small current.
[0040] In addition, with this operation gestalt, although moving part 20 is rotated to the circumference of the X-axis and a Y-axis, naturally this invention is not necessarily limited only to the circumference of biaxial, and can be applied also to an objective lens driving gear which is leaned only to either of the circumferences of the X-axis or a Y-axis.
[0041] In addition, although N.P of an objective lens 1 and backside principal point Ho' are in agreement with this operation gestalt since infinity optical system is adopted, when finite optical system etc. is adopted, it is not restricted to this, but N.P and backside principal point Ho' shift.
[0042] Next, the 2nd operation gestalt of this invention is explained with reference to drawing 7 thru/or drawing 10 . This objective lens driving gear carries out migration to Z shaft orientations of moving part 40, and rotation of the circumference of a Y-axis.
[0043] Hereafter, the configuration of the objective lens driving gear of this operation gestalt is explained. In the both-sides side of the direction of X of the holder (attachment component) 22 which the objective lens 21 fixed, the coil 25 (251,252) wound around the prismatic form has fixed. An

objective lens 21, a holder 22, and a coil 25 constitute moving part 40. Heights 26 are formed in the side face of the direction both sides of Y of this holder 22, fitting of these heights 26 is carried out to 27g of holes of prism section 27a of the supporter material 27, and they fix. This prism section 27a constitutes the attachment section which attaches a holder 22. Between prism section 27a and piece of junction 27b, thin meat-like connection section 27c (supporter material) is formed, and prism section 27a is connected by connection section 27c. This connection section 27c is based on the support S of the circumference of the Y-axis of moving part 40, and the holder 22 which fixes to the supporter material 27 is rotated to the circumference of a Y-axis focusing on this connection section 27c.

[0044] Moving part 40 consists of an objective lens 21, a holder 22, a coil 25 (251,252), and prism section 27a. The supporter material 27 is making the parallel link configuration, and consists of fixed part 27e which is connected with the other end of 27d of four link sections which extend in the direction of X from two both ends, piece of junction 27b, and piece of two junction 27b, in which prism section 27a was formed, and 27d of four link sections, and is fixed to the base 31. 27f of hinge regions of a thin-walled part with the very thin connection part between piece of junction 27b and 27d of link members and between 27d of link sections and fixed part 27e is formed. The supporter material 27 is really fabricated with an ingredient with 27 deformablef of hinge regions, for example, a polyurethane elastomer.

[0045] Outside York 31a is formed in the both sides of the direction of X of the base 31, in the inside, it has a gap and inner York 31b is formed. In inner York 31b of outside York 31a, and the field which counters, a magnet (field generating means) 33 fixes, respectively, and a magnetic gap is formed between inner York 31b.

[0046] The outside on the left-hand side of [in drawing] the base 31, the side face inside fixed part 27e of the supporter material 27 fixes in the side face of the outside of York 31a, and the supporter material 27 is fixed to it to the base 31.

[0047] It regards as N.P of an objective lens, and the center of gravity G of moving part 40 and connection section 27c from Y, and the objective lens driving gear of this operation gestalt is in agreement, as the center of spacing of two coils 25 of the both sides of a holder 22, N.P of an objective lens 21, and the center of gravity G of moving part 40 and connection section 27c S, i.e., a support core, are located in a line in a straight line and it is shown in drawing 9 .

[0048] About the tracking drive of an objective lens 21, an objective lens 21 is not made to drive but it is made to carry out by forming other tracking drives, for example, a galvanomirror etc.

[0049] Thus, an operation of the objective lens driving gear of the constituted 2nd operation gestalt is explained below. As shown in drawing 10 , the drive current of the signal which added the focusing servo signal and the tilt servo signal is impressed to a coil 251, and the drive current of the difference signal of a focusing signal and a tilt servo signal is impressed to a coil 252.

[0050] In carrying out the variation rate of the objective lens 21 to the Z (+) side of the direction of focusing, it impresses the drive current of a signal which driving force generates in the Z (+) side to a coil 251,252. In both the coils 251,252, the driving force by the side of Z (+) occurs, and the variation rate of the moving part 40 is carried out to the Z (+) side. Under the present circumstances, 27f of hinge regions of the supporter material 27 is deformed, and the variation rate by the side of Z (+) of moving part 40 is made possible by carrying out the variation rate of piece of junction 27b of the branch member 27, and the 27d of the link sections.

[0051] Moreover, in rotating an objective lens 21 to the circumference of a Y-axis, the drive current of the reverse sense is impressed to a coil 251,252, respectively, and it makes it the driving force generated with a coil 251,252 become the reverse sense mutually in a Z direction. In moving part 40, the moment of the circumference of the Y-axis centering on connection section 27c occurs, and moving part 40 rotates to the circumference of a Y-axis c [connection section 27], i.e., a core [core / S / support], because connection section 27c deforms.

[0052] Since N.P of an objective lens 21 and the center of gravity G of moving part are in agreement on the Y-axis which connection section 27c is based on the support S of only the circumference of a Y-axis, and passes along the connection section 27c in the case of this operation gestalt, even if moving part 40

rotates focusing on connection section 27c which is based on Support S, the location of N.P of an objective lens 21 does not shift, therefore the location of an optical spot does not shift, either.
[0053] Moreover, since connection section 27c is the supporter material of the revolving shaft of the circumference of the Y-axis of moving part, it can be clear in being on the Y-axis by which the location based on [S] support passes along connection section 27c, and the location based on [S] support can understand it easily as compared with the 1st operation gestalt, and it can make the support core S and N.P of an objective lens correctly in agreement.
[0054] Moreover, since it is very high, even if the center of gravity G of moving part 40 has shifted from on the Y-axis which passes along connection section 27c somewhat as compared with the rigidity of deformation of the circumference of a Y-axis of the rigidity of deformation of those other than the circumference of a Y-axis of connection section 27c, moving part 40 will rotate focusing on connection section 27c, and the tolerance of the dimensional accuracy of components or assembly precision spreads.

[0055] Moreover, since 27d of link sections of the supporter material 27 made it extend in the direction of X in the direction of tracking, 27d of link sections does not transform an objective lens driving gear in the direction of X to the acceleration of the direction of X produced when a high speed is accessed in the direction of X, and an exact focusing servo and a tilt servo become possible.
[0056] In addition, a tilt coil can be added to this operation gestalt, and it can also lean to the circumference of the X-axis. For example, moving part 40 can be rotated also to the circumference of the X-axis by carrying out 4 (two being shown by a diagram) arrangement of the tilt coil 253 as shown in drawing 7 , and generating the force as shown in drawing.
[0057] In addition, in each above-mentioned operation gestalt, although N.P of an objective lens was made in agreement focusing on [S] support of the center of gravity G of moving part, or supporter material If an objective lens driving gear is constituted by extent to which a center of gravity G or the support core S is located in the interior of an objective lens The gap with objective lens N.P, a center of gravity G, and the support core S is about 0-2mm, even if it takes it into consideration from a viewpoint on optical precision, it can make movement magnitude of an optical spot very small, and it can fully attain the purpose of this invention.
[0058] Moreover, in each above-mentioned operation gestalt, although the tilt coil was fixed to moving part and the magnet has been arranged at the base of a fixed side, even if it is the so-called objective lens driving gear of the MUBINKU magnet type which fixes a magnet to moving part and arranges a tilt coil at the base, the purpose of this invention can be attained.
[0059] Moreover, in each above-mentioned operation gestalt, supporter material may be a wire etc. 4 wires are desirable if it is a wire. Moreover, if an objective lens can be used in order to form an optical spot in a disk, and an optical spot can be formed in a disk, it will not be limited to an objective lens. For example, you may be a hologram. Moreover, although the objective lens and the holder were used as another member and the objective lens is fixed to a holder, an objective lens and a holder are really fabricated and, naturally this invention is applied also as one component.
[0060]
[Effect of the Invention] Since the rotation core of moving part is in agreement with the nodal point of an objective lens according to this invention even if it rotates moving part by in collaboration with a tilt coil and a field impression means as explained above, the nodal point of an objective lens does not displace greatly and the optical spot from an objective lens is not displaced greatly, either.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the objective lens driving gear in the information record regenerative apparatus which records or reproduces information optically to a record medium, for example, a Magnetic-Optical disk drive, a postscript mold disk drive, a phase change mold disk drive, a CD-ROM drive, a DVD drive, etc.

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PRIOR ART

[Description of the Prior Art] In the information record regenerative apparatus which reproduces information at least optically to a record medium, convergent radiotherapy of the light beam is carried out with an objective lens, a very small light spot is formed on a record medium, and the information signal is reproduced. However, if the optical axis of an objective lens does not make it irradiate by the proper angle of incidence to the information recording surface of a record medium, optical aberration will occur, a cross talk and a jitter will increase, and an information signal will deteriorate. Moreover, if the optical axis of an objective lens inclines in case information is recorded on an information recording surface, the information signal which should be recorded will deteriorate and the fault that a right pit mark is not formed will arise.
[0003] In order to solve such fault, the objective lens driving gear indicated by JP,7-65397,A (it is hereafter called the conventional example 1) is proposed. The objective lens driving gear indicated by this conventional example 1 is shown in drawing 11 . Hereafter, with reference to drawing 11 , the configuration of this objective lens driving gear is explained.
[0004] As shown in drawing 11 , Y and the direction of a path of an optical disk are set [the direction of an optical axis of an objective lens 51] to X for the hoop direction of Z and an optical disk. The objective lens 51 is held at the holder 52. the focal coil 53 winds around the side face of a holder 52 horizontally -- having -- moreover -- the side face of the hoop direction (the direction of Y) of a holder 52 -- the tracking coils 54a-54d (not shown [54d]) -- moreover, the tilt coils 55a-55d (not shown [55d]) are attached in the part located in each tracking coils [54a-54d] lower part.
[0005] The 1st and 2nd tilt coil 55a and 55b and the 3rd and 4th tilt coil 55c and 55d are arranged along the direction of a path of an optical disk so that it may become the X-axis and axial symmetry. In this case, the tilt coils 55a and 55c and the tilt coils 55b and 55d will be arranged along the hoop direction of an optical disk.
[0006] On both sides of the objective lens 51, the direction inclination detectors 61a and 61b of a path are attached in the top face of a holder 52 along the direction of X. Moreover, on both sides of the objective lens 51, the hoop direction inclination detectors 61c and 61d are attached along the direction of Y.
[0007] The end of four parallel supporting material 56a-56d fixes on the side face of this holder 52, and the other end fixes to the supporting-material fixed part 58 attached on the pedestal 57. A holder 52 supports supporting material 56a-56d possible [jogging and tilting in the four directions of the direction a of a focus (Z-axis), the direction b of tracking (X-axis), direction inclination of path c, and hoop direction inclination d].
[0008] York 59a and 59b of the U character mold of a pair is attached in the direction of Y at the pedestal 57, and Magnets 60a and 60b have fixed in York 59a and 59b of the pair. York 59a and 59b constitutes the magnetic impression means with Magnets 60a and 60b.
[0009] Thus, actuation of the constituted objective lens driving gear is further explained also with reference to drawing 12 . The diffracted light which does not return to an objective lens 51 among the light which outgoing radiation was carried out from the objective lens 51, and condensed to optical disk

D is received by the direction inclination detectors 61a and 61b of a path, and the hoop direction inclination detectors 61c and 61d. The optical axis of an objective lens 51 does not incline in the direction c of a path to optical disk D, but drawing 12 (a) shows the condition that the light income of the diffracted light received with the direction inclination detectors 61a and 61b of a path is equal. That is, an error signal does not arise in this condition. On the other hand, drawing 12 (b) shows the condition that the optical axis of an objective lens 51 leans in the direction c of a path to optical disk D, a difference arises in the light income of the direction inclination detectors 61a and 61b of a path, and an error signal arises.

[0010] That is, the inclination of the direction c of a path of an objective lens 51 can be amended by impressing a drive current to the tilt coils 55a-55d so that the error signal from the direction inclination detectors 61a and 61b of a path may be set to 0.

[0011] The inclination of the hoop direction d of the optical axis of an objective lens 51 can be amended like the case of the direction c of a path also about a hoop direction d by impressing a drive current which amends the error signal from the hoop direction inclination detectors 61c and 61d to the tilt coils 55a-55d.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] Since the rotation core of moving part is in agreement with the nodal point of an objective lens according to this invention even if it rotates moving part by in collaboration with a tilt coil and a field impression means as explained above, the nodal point of an objective lens does not displace greatly and the optical spot from an objective lens is not displaced greatly, either.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the objective lens driving gear shown in drawing 11 , since the objective lens 51 is attached above the holder 52, when the objective lens 51 and the center of gravity of moving part (it consists of an objective lens 51, a holder 52, and each drive coil) have shifted in a Z direction and an objective lens 51 is leaned by 55d from tilt coil 55a, the fault which displaces in the direction which the objective lens leaned and also displaces an optical spot in connection with it will arise.
[0013] For example, if the drive current of the predetermined sense is impressed to 55d from tilt coil 55a so that the optical axis of an objective lens 51 may be leaned to the circumference of a Y-axis, an objective lens 51 will move in the direction of X while inclining to the circumference of a Y-axis, and an optical spot will move it in the direction of X. Migration of this optical spot needs to serve as disturbance of the direction of X, and needs to amend by impressing a drive current to the tracking coils 54a-54d. Therefore, the load of the servo of the direction of tracking becomes large, and the fault which the consumed electric current increases is caused.
[0014] Moreover, like the case of the circumference of the X-axis, when the optical axis of an objective lens is leaned to the circumference of the X-axis, an objective lens will move in the direction of Y while inclining to the circumference of the X-axis, and an optical spot will move it in the direction of Y. Since it does not have a drive for making an objective lens drive in the direction of Y in the common objective lens driving gear in an information record regenerative apparatus, migration of an optical spot in this direction of Y cannot be amended. Therefore, a jitter occurs, the reflected light from a record medium, incidence will be carried out, offset will arise in a tracking error and a focusing error signal, and an exact servo will become impossible. [to the object for tracking, and the photodetector for focusing]
[0015] Even if this invention was made paying attention to such fault and performs inclination amendment of an objective lens, it aims to let the optical spot of an objective lens offer the objective lens driving gear which is not displaced greatly.

[Translation done.]

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the objective lens driving gear of this invention An objective lens, the attachment component holding said objective lens, and the supporter material supported possible [displacement of said attachment component], In the objective lens driving gear which has the tilt coil which fixes to said attachment component and is made to rotate said attachment component to the circumference of the shaft which intersects perpendicularly with the direction of an optical axis of said objective lens mostly, and the field impression means to which magnetic flux is made to impress to said tilt coil The rotation core of said objective lens by in collaboration with said tilt coil and a field impression means was constituted so that it might be mostly in agreement with the nodal point of said objective lens.
[0017] For this reason, even if it rotates an attachment component by in collaboration with a tilt coil and a field impression means, it will rotate focusing on the nodal point of an objective lens mostly, the nodal point of an objective lens does not shift greatly, and an attachment component becomes very small [the amount of displacement of an optical spot].
[0018] It is more specifically making in agreement the rotation core of said objective lens, and the center of gravity of the moving part which rotates to the circumference of said shaft, and constituting an objective lens driving gear, and even if it rotates moving part on a low frequency, the amount of displacement of an optical spot becomes very small.
[0019] Moreover, with making it in agreement focusing on the support supported by the rotation core and said supporter material of said objective lens, and constituting an objective lens driving gear, even if it rotates moving part on a high frequency, the amount of displacement of an optical spot becomes very small.
[0020]
[Embodiment of the Invention] Hereafter, the objective lens driving gear concerning the 1st operation gestalt of this invention is explained with reference to drawing 1 thru/or drawing 6 .
[0021] This objective lens driving gear is an objective lens driving gear in the Magnetic-Optical disk drive which uses a magneto-optic disk as a record medium, and performs record and playback to a magneto-optic-recording medium. Among the axes of coordinates in drawing, as for the direction of X, the direction of tracking (the direction of a normal of a code track) and the direction of Y show the tangential direction (tangential direction of a code track), and the Z direction shows the direction of focusing (they are a perpendicular direction and the direction of an objective lens optical axis to a magneto-optic-disk side).
[0022] As shown in drawing 1 , the objective lens 1 has fixed to the through hole formed in the center of a holder (attachment component) 2. A slot is formed in the top face of a holder 2 so that an objective lens 1 may be surrounded, and the focusing coil 3 wound around the slot is inserted, and fixes. Moreover, also in the direction of Y of a holder 2, two wound tracking coils 4 fix in a side face, and two wound tracking 4 fixes also like the side face of another side. In each outside of this tracking coil 4, a total of four tilt coils 5 fixes.
[0023] Moving part 20 consists of edges 9c and 10c by the side of an objective lens 1, a holder 2, the

focusing coil 3, the tracking coil 4, the tilt coil 5, and the holder 2 of flat spring 9 and 10.
[0024] The fixing sections 6 and 6 are formed in the both sides of the direction of X of a holder 2, and the end of retaining springs 7 and 8 fixes in these fixing sections 6 and 6, respectively. A retaining spring 7 consists of flat spring (supporter material) 9 and 10 which has 0.5 thru/or an about 1.5mm gap, and is arranged up and down, and damping materials, such as silicon gel poured into the gap, as shown in drawing 2 . As for flat spring 9 and 10, the bending sections 9a and 10a of a narrow width are formed near the edges 9c and 10c of the direction both ends of Y, respectively. These bending sections 9a and 10a are formed so that it may shift in the direction of X slightly, as shown in drawing 3 (a). The bending sections 9b and 10b which bent crosswise (the direction of X) flank one side at the right angle are formed in the pars intermedia between [of two places] bending section 9a and 10a. And the bending sections 9b and 10b are attached so that it may counter mutually, and the cross section in the Z-X flat surface is constituted so that an oblong rectangle may be presented, as shown in drawing 2 . In addition, since a retaining spring 8 is constituted like a retaining spring 7, it omits the explanation.
[0025] The other end of retaining springs 7 and 8 fixes to the fixed part 12 which starts from the base 11 and is formed. Two magnets 13

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is the whole objective lens driving gear perspective view concerning the 1st operation gestalt of this invention.
[Drawing 2] Drawing 2 is the Z-X sectional view of the retaining spring 7 of the objective lens driving gear of the 1st operation gestalt.
[Drawing 3] Drawing 3 (a) and (b) ** the top view of the retaining spring 7 of the objective lens driving gear of the 1st operation gestalt, and the condition before a retaining spring 7 deforms drawing (a), and drawing 3 (b) are drawings showing the condition that the retaining spring 7 deformed.
[Drawing 4] Drawing 4 is the perspective view having shown the focusing coil of the objective lens driving gear of the 1st operation gestalt, the tracking coil, and the tilt coil in diagram.
[Drawing 5] Drawing 5 is an A-A sectional view in drawing 1 .
[Drawing 6] Drawing 6 (a) and (b) are drawings showing the amount of displacement of the optical spot at the time of an objective lens inclining, drawing 6 (a) is the conventional case and drawing 6 (b) shows the case of the 1st operation gestalt.
[Drawing 7] Drawing 7 is the decomposition perspective view of the objective lens driving gear concerning the 2nd operation gestalt of this invention.
[Drawing 8] Drawing 8 is the whole objective lens driving gear perspective view of the 2nd operation gestalt.
[Drawing 9] Drawing 9 is the side elevation which looked at the moving part of the objective lens driving gear of the 2nd operation gestalt, and its circumference from Y.
[Drawing 10] Drawing 10 is the block diagram showing the drive circuit which makes a coil drive.
[Drawing 11] It is the decomposition perspective view showing the conventional objective lens driving gear.
[Drawing 12] It is the explanatory view of the conventional objective lens driving gear of operation, and drawing 12 (a) is drawing showing the case where drawing 12 (b) has the inclination of a beam optical axis, when there is no inclination of a beam optical axis.
[Description of Notations]
1 Objective Lens
2 Holder
3 Focusing Coil
4 (41, 42, 43, 44) Tracking coil
5 (51, 52, 53, 54) Tilt coil
7 Eight Retaining spring
9 Ten Flat spring
11 Base
12 Fixed Part
13 Magnet
14 Outside York

20 Moving Part

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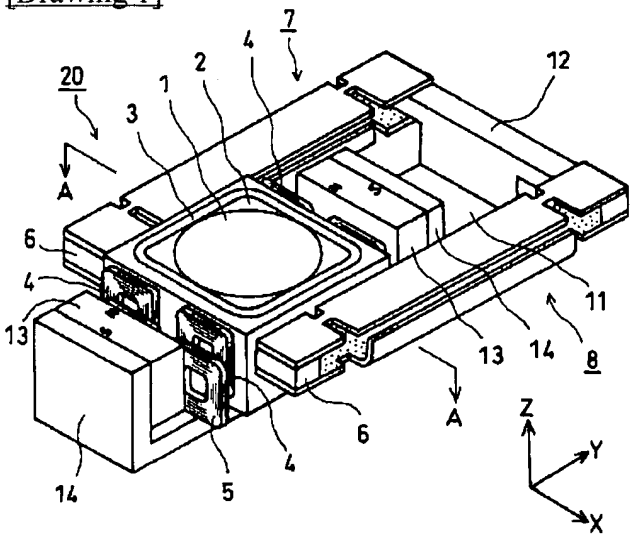
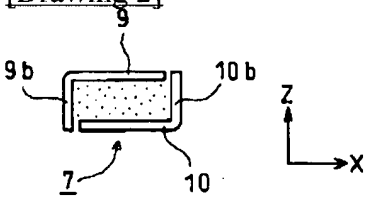
DRAWINGS

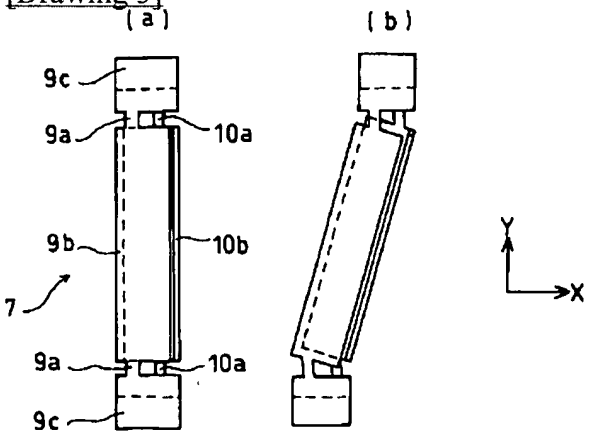
[Drawing 1]



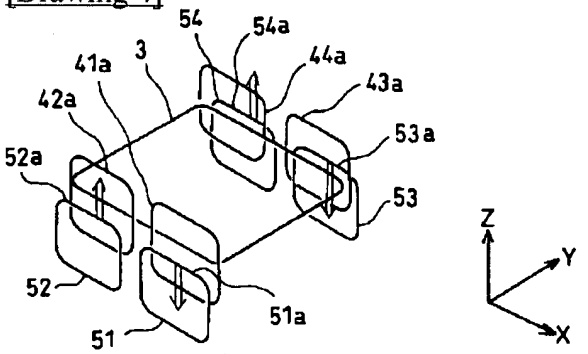
[Drawing 2]



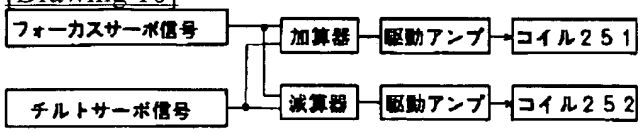
[Drawing 3]



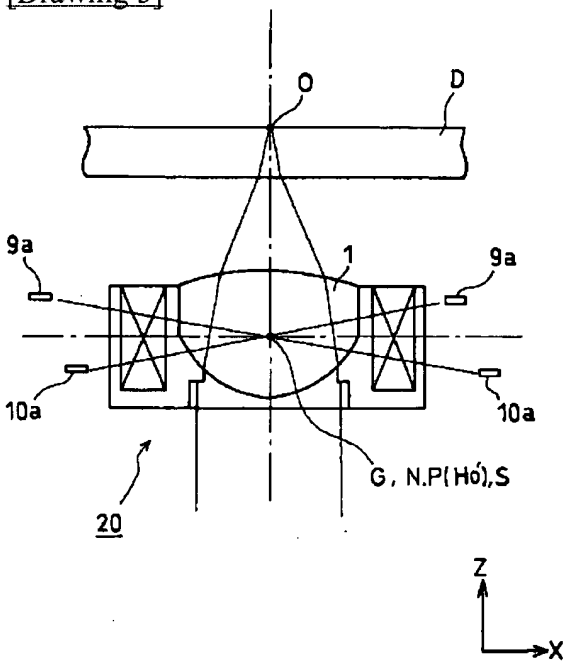
[Drawing 4]



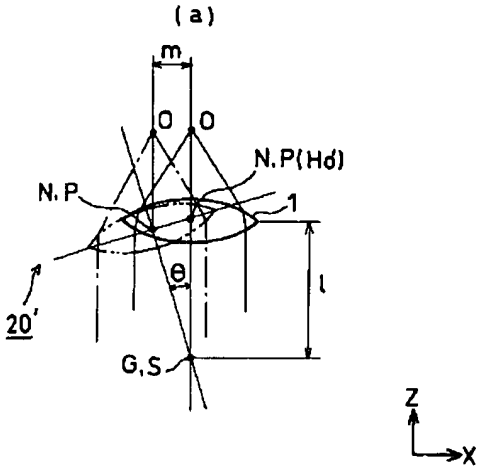
[Drawing 10]

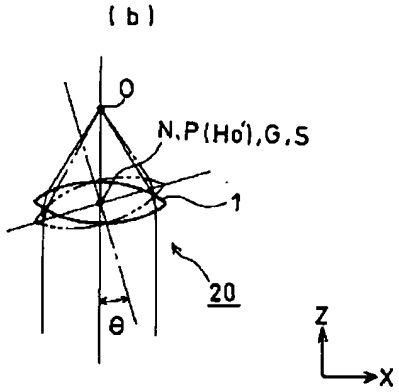


[Drawing 5]

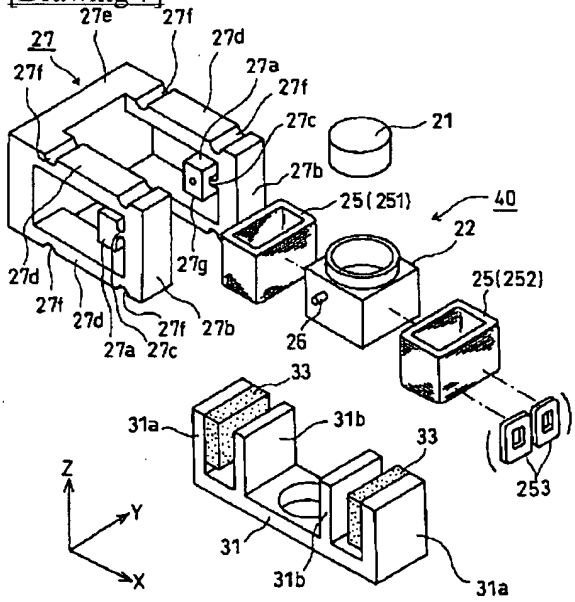


[Drawing 6]

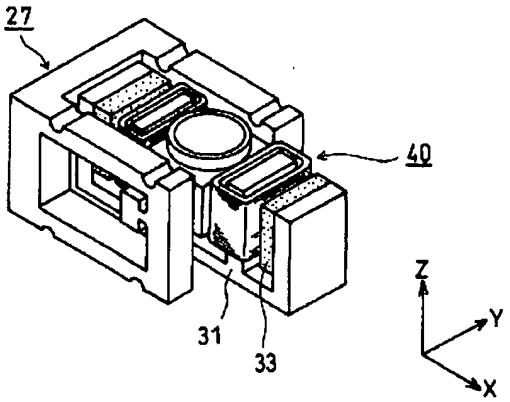




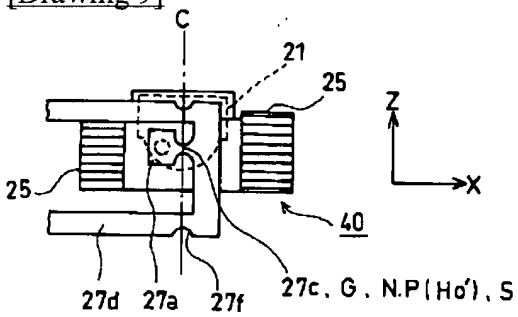
[Drawing 7]



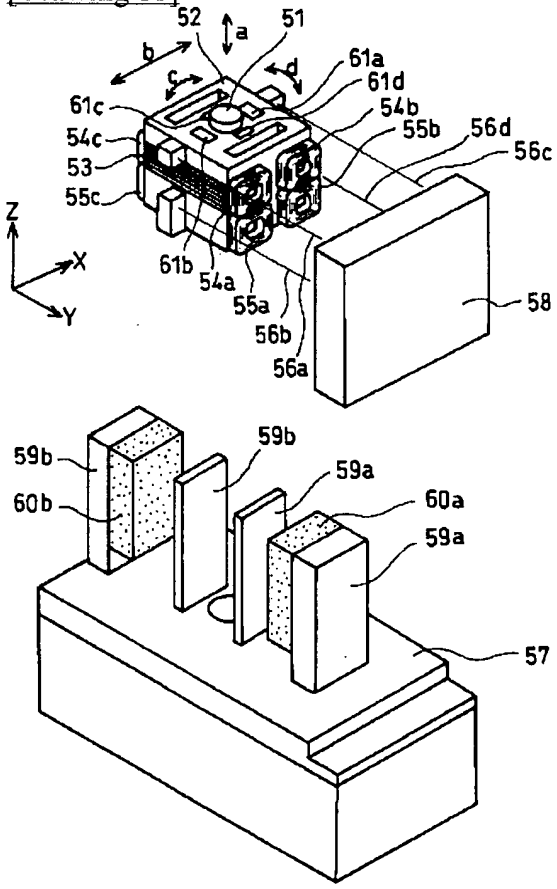
[Drawing 8]



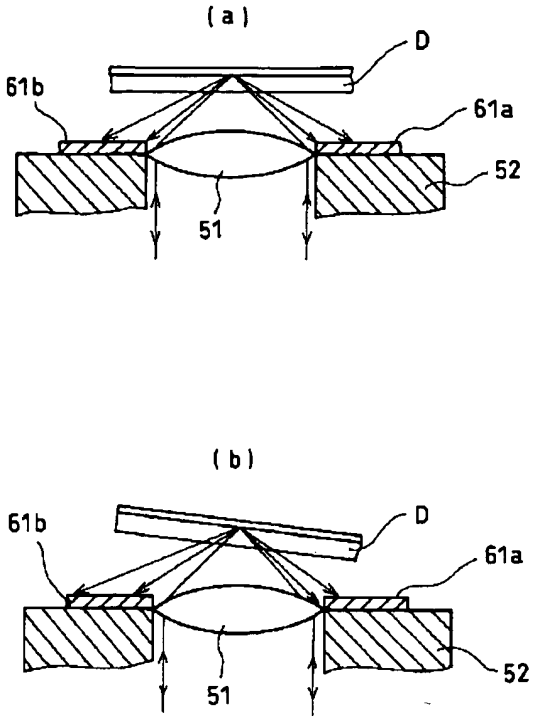
[Drawing 9]



[Drawing 11]



[Drawing 12]



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